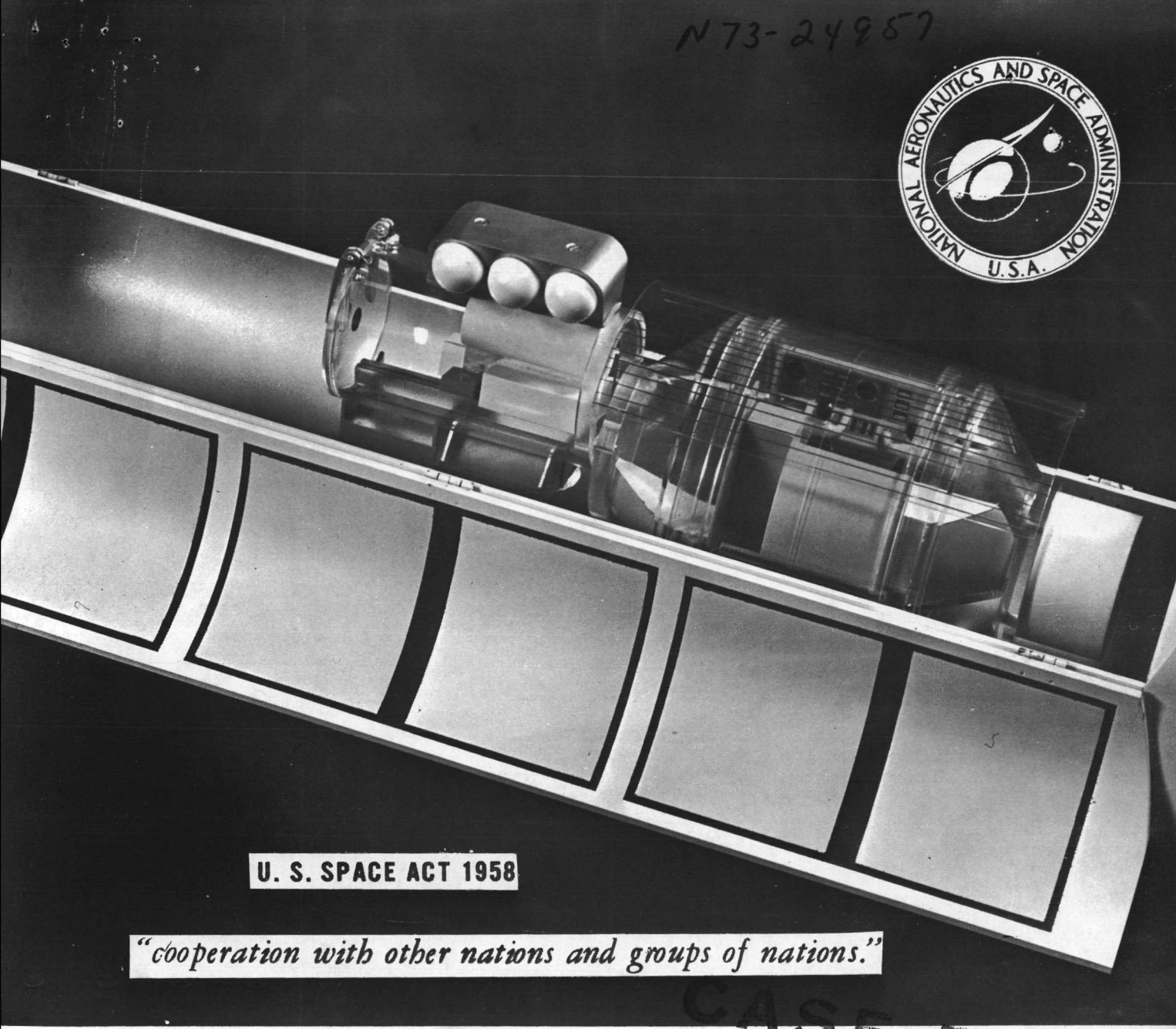


U. S. SPACE ACT 1958

"cooperation with other nations and groups of nations."

INTERNATIONAL PROGRAMS

MAY 1973

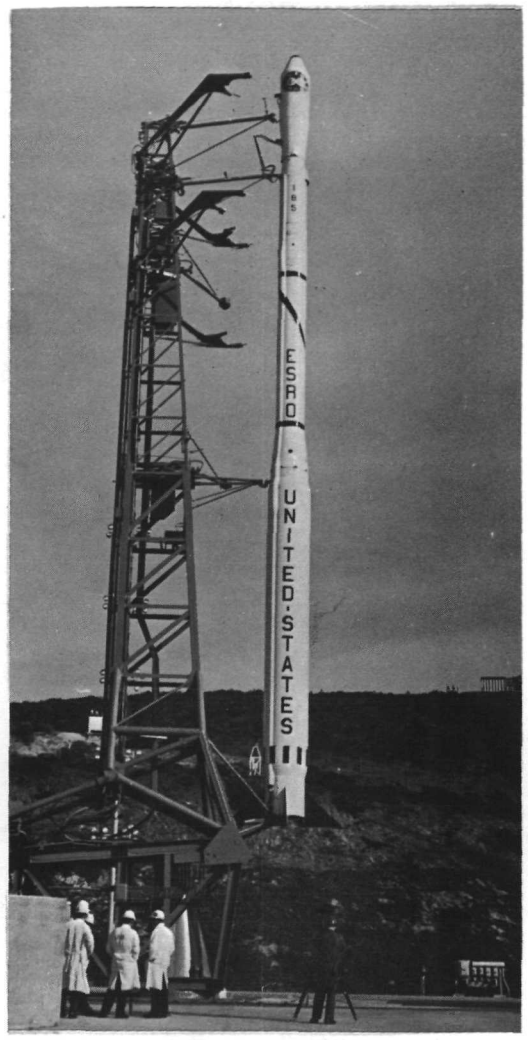
I N D E X

(Editors: This fact sheet contains information on NASA's international activities. It is suggested that it be retained in your files).

Cover: Sortie Lab. Shown in the payload bay of the Space Shuttle Orbiter is a model of the Spacelab (European designation of Sortie Lab) where scientific investigators can work with direct access to their experiment equipment. Experiment disciplines which can be accommodated in the Spacelab are astronomy, space physics, life sciences, Earth observations, material sciences and manufacturing, communications and navigation, and advanced technology. The European Space Research Organization (ESRO) voted in January 1973 to study the development of a Spacelab as an integral element of NASA's Shuttle system of the 1980s.

May 1973

Figure 1. European Space Research Organization (ESRO) satellite prior to launch by a Scout vehicle from NASA's Western Test Range, Calif. Successfully orbited on November 21, 1972, ESRO-IV was the fifth reimbursable launch by NASA for the European ten-nation organization.



INTERNATIONAL PROGRAM

The National Aeronautics and Space Administration's international activities are based on the National Aeronautics and Space Act of 1958 which provides that United States space activities be conducted so that they contribute materially to cooperation with other nations and groups of nations. In its international cooperative activities NASA demonstrates peaceful purposes, profits from foreign scientific and financial contributions to common space objectives, and shares the resulting benefits.

NASA has entered into more than 500 agreements for international space projects; orbited 24 foreign satellites on a cooperative or reimbursable basis; flown 26 foreign experiments on its spacecraft; participated in more than 790

cooperative scientific rocket soundings from sites in all quarters of the world, and involved more than 340 foreign scientists in the analysis of lunar surface samples.

NASA is now preparing the first international manned space mission, the Apollo-Soyuz Test Project with the Soviet Union, and the European Space Research Organization (ESRO) is conducting systems definition studies aimed at the development and manufacture of a Sortie Laboratory as an integral element of the U.S. Space Shuttle system.

Direct daily reception of data from U.S. weather satellites on inexpensive Automatic Picture Transmission (APT) receivers is carried out by some 74 countries which use the data themselves and also pass it on to us. Major ground stations in a dozen countries have participated in the experimental testing of communications satellites.

For a successful space mission of any kind, tracking and fast reliable communications are a necessity; with the cooperation of 8 countries, NASA operates a worldwide network which ensures line-of-sight communication as spacecraft circle a rotating Earth.

Cooperative aeronautical projects have been carried out with Canadian, French, German and British agencies which are contributing importantly to the development and testing of a variety of vertical and short take-off-and-landing aircraft.

These varied international projects provide three kinds of benefits to the United States and her cooperating partners.

There are cost savings when, for example, Canada assumed responsibility for a series of satellites in the NASA ionospheric research program; when Germany assumed responsibility for the spacecraft for a major solar probe program, and when countries, such as Brazil, India and Norway, provide extensive range support for sounding rocket projects which require their unique geographical locations.

There are scientific benefits when uniquely qualified foreign experimenters win opportunities to fly their instruments on NASA satellites after competitive selection. Scientific benefits have also come, for example, from wholly new data obtained from the Canadian topside sounder satellite and the Italian atmospheric density satellites, from such new techniques as the German barium cloud experiment for investigating

the Earth's magnetic field in space, from the exchange of biomedical information with the Soviet Union and from the global observations which have been organized in support of radio propagation and geodetic satellite programs.

There are technological benefits when, in joint projects, Canadian engineers pioneered in swept-frequency ionospheric sounders and in extensible spacecraft booms and French engineers advanced the state of the art in balloon technology, remote sensors, spacecraft engineering and aircraft hazard testing.

It may be assumed that there are also political benefits from the open and peaceful U.S. space program -- in the reduction of international tensions through the demonstration of common human interest and provision of frequent opportunities for cooperation.

A basic principle of NASA's international cooperative programs is that each participating country carry the financial responsibility for its own contributions to joint cooperative projects.

Other principles are that projects be of scientific validity and mutual interest, of specific rather than generalized character, that they be openly conducted and that their scientific results be shared by all participants.

In addition to cooperative projects outlined above, the launching of foreign scientific and applications spacecraft on a cost-reimbursable basis is an international activity of growing importance, both for its accommodation of foreign interests and its contribution to the U.S. balance of payments:

- Five satellites of the European Space Research Organization (ESRO) have been successfully orbited on a reimbursable basis. The first was HEOS-1, an interplanetary physics research satellite launched by a Thor-Delta rocket in December 1968. This was followed by a backup flight (BOREAS) of the ionospheric satellite Aurorae in 1969 and three launchings of ESRO scientific satellites in 1972.

- Anik I, the first of a series of Canadian domestic communications satellites, was launched on November 9, 1972 on a cost-reimbursable basis. Anik II was launched in April, 1973.

- A reimbursable launching agreement between the United States and the United Kingdom was concluded on January 17, 1973. The UK Department of Trade and Industry (DTI) will purchase appropriate boosters and launching services from NASA for satellite projects undertaken by DTI. The X-4 technology research satellite, the first spacecraft planned to be launched under the agreement, is scheduled to be placed in orbit in 1974.

- An Italian experimental microwave propagation satellite, "SIRIO", is planned for reimbursable launch in 1975, and discussions are underway with Japan, Germany and others.

- Since the launch of Intelsat I (Early Bird) in April 1965, NASA has successfully orbited 12 Intelsat communications satellites, positioned over the Atlantic, Pacific and Indian Oceans to provide global international communications. Three more launches are on the 1973 calendar. These reimbursable launches are conducted for COMSAT which represents the U.S. in the International Telecommunications Satellite Consortium (INTELSAT).

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NASA's international programs can be categorized in five principal areas: manned space flight, space sciences, space applications, the ground support of space operations, and cooperative international aeronautics research.

There follows a brief, selective summary description of these programs.

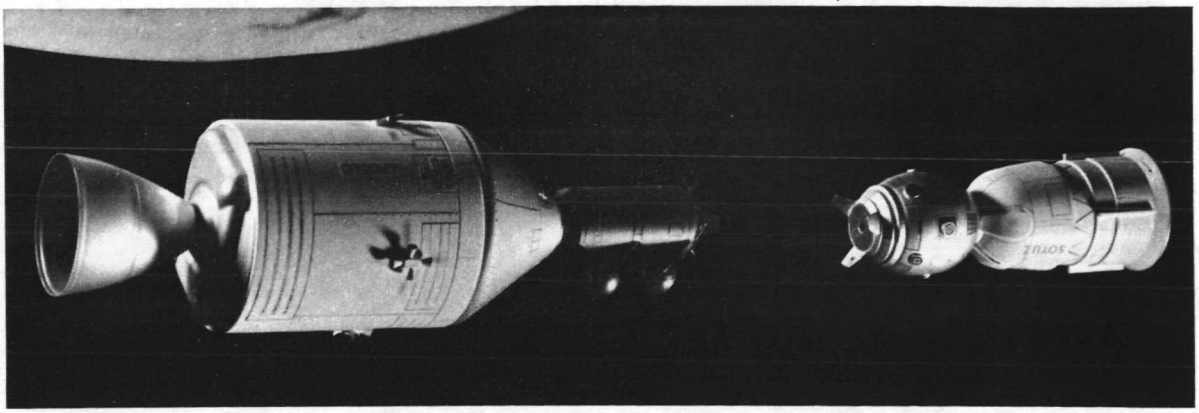

Figure 2. A model of the Soviet Union's Soyuz and the U.S. Apollo Spacecraft, shown in simulated rendezvous prior to docking in Earth orbit. The Docking and Crew transfer Module is attached to the Apollo Command Module. The first international manned space flight is planned for 1975.

I. MANNED SPACE FLIGHT

Skylab

Skylab, the Earth orbiting manned space laboratory with 1973 launchings, includes international experiments:

- An ultraviolet panorama experiment provided by the French National Scientific Research Center.

- Two experiments for use of the multipurpose furnace: one for the production of silicon carbide whisker reinforced composite metals by the Japanese National Research Institute for Metals; the other by Catholic University of Louvain, Belgium, for the study of pore size and pore shape of silver grids melted and solified in a weightless condition.

- Forty-four investigations selected from 43 scientists in 21 countries and one international organization for analysis of data obtained by the Earth Resources Experiments Package (EREP).

- Physicians from the German Air Force and the Royal Air Force (UK), participating with the NASA biomedical team are

to evaluate effects of long-duration space flight on crews.

Sortie Lab

After nearly three years of discussion of possible European participation in the development and utilization of future space-shuttle related systems, the European Space Conference in December 1972 endorsed the development of a Sortie Laboratory as a funded contribution to the U.S. space transportation system to operate in conjunction with the Space Shuttle. In January of 1973, the Council of the European Space Research Organization (ESRO) agreed to establish an ESRO Special Project for the study and development of a Sortie Laboratory (called Spacelab in Europe). Negotiations for confirming agreements between ESRO and NASA and the governments concerned were undertaken in 1973.

The European Sortie Laboratory represents a significant contribution to the space transportation system in an area not funded by the U.S. It provides for the timely availability of a supporting system important to realizing the full potential of the Shuttle; it will also facilitate joint use programs, many entailing the activities of U.S. and European astronauts.

Anticipating that the Space Shuttle will be the principal vehicle for space transport and experimentation in the eighties, NASA has invited participation by European scientists in a number of study groups to develop recommendations for early Shuttle use and to define the interface and support requirements these uses will impose on the Sortie Laboratory and the Shuttle Orbiter. In parallel, ESRO has organized its own utilization planning groups.

Apollo-Soyuz Test Project

ASTP is a first step toward international cooperation in manned space flight, taken by the United States and the Soviet Union. An agreement for the purpose, signed by President Nixon and Chairman Kosygin of the USSR Council of Ministers on May 24, 1972, provides for the development of compatible rendezvous and docking systems for future manned spacecraft of both the United States and the Soviet Union. It also points the way to future joint space activities of a cooperative and perhaps economic character. Culmination of the program is an experimental rendezvous and docking mission to be flown in Earth orbit in 1975 with Apollo and Soyuz spacecraft.

The objectives of the mission are to test technical solutions for compatibility of systems for docking manned spacecraft of the United States and the Soviet Union. This includes the flight test of a compatible rendezvous system, the flight test of a compatible docking system, the verification of procedures for joint crew transfer, joint crew activities while docked and, generally, gaining experience in conducting joint USA/USSR flights, including the development of an international space rescue capability.

It is planned that the Soyuz spacecraft with two cosmonauts will be launched from the USSR prior to launch of the Apollo spacecraft. The Apollo Command and Service Module with three astronauts is to be launched from the United States to rendezvous with the Soyuz in a circular orbit at an altitude of approximately 230 kilometers. While docked, there will be crew transfers and joint operations for about 2 days before separation.

The Apollo spacecraft will be augmented by a special Docking Module designed to provide compatibility with the docking system being added to the Soyuz vehicle.

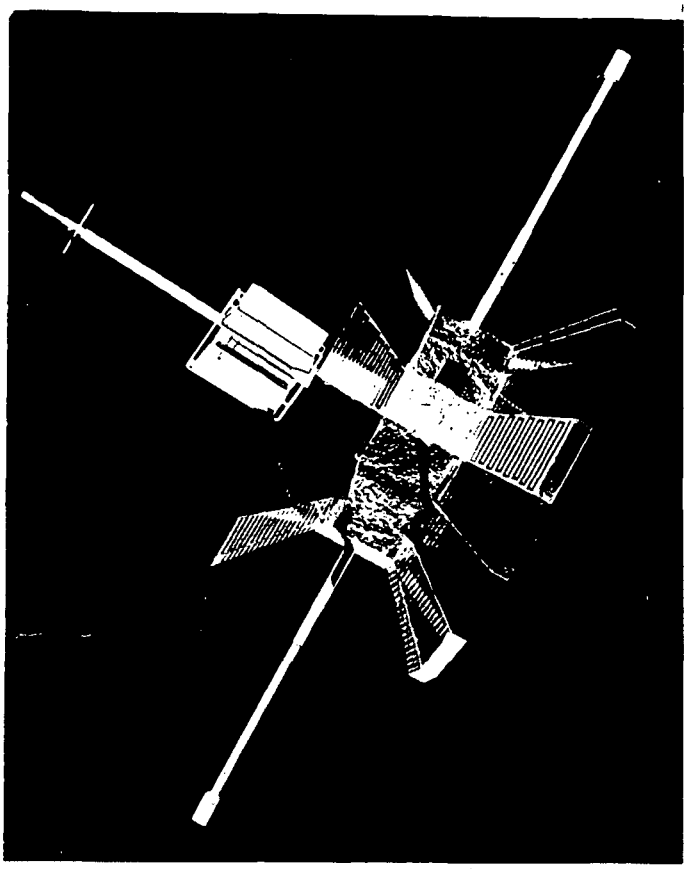

Figure 3. The Helios spacecraft to be launched in 1974 and 1975 will venture two-thirds the distance to the Sun. This solar probe is a joint effort between the Federal Republic of Germany and the United States.

II. SPACE SCIENCES

Cooperative Satellite Projects

Cooperative satellite projects have been the major elements of international space sciences programs. In these projects, foreign participants have contributed the satellites, and NASA the launchings. Both parties often contribute experimental payloads.

To date, there have been 18 such cooperative launchings of spacecraft built by the United Kingdom, Canada, France, Italy and Germany, as well as by the European Space Research Organization (ESRO). Six additional cooperative satellite projects have been agreed, and prospects for the continuation and growth of cooperative satellite programs appear excellent.

Cooperative Solar Probe

The U.S. and Germany agreed in 1969 to the most ambitious cooperative spacecraft effort yet undertaken. In project HELIOS, two German spacecraft carrying seven German and three U.S. experiments will be launched by NASA to make

physical measurements about two-thirds of the way from Earth to the Sun, closer than any spacecraft has flown before. HELIOS will complement the NASA Pioneer series of spacecraft in providing total solar system coverage. Of the overall cost, approximately $150,000,000, Germany will bear the major portion.

The importance of studies of the Sun, which add to knowledge about its influence on Earth, relate dramatically to the need for more data on the source and processes of the Sun's energy.

Lunar Sample Analysis

The program to analyze lunar samples returned in the six Apollo lunar landings has involved 89 Principal Investigators from 19 countries -- Australia, Belgium, Brazil, Canada, Republic of China, Czechoslovakia, ESRO, Finland, France, Germany, India, Italy, Japan, Korea, Norway, South Africa, Spain, Switzerland and the UK. Thus nations around the world are afforded the opportunity to share, in a scientifically significant way, in lunar exploration. The investigators, selected on the merits of their proposals and with their own financial support, are performing physical, chemical, mineralogical and biological experiments on the lunar samples, along with their 139 American colleagues. In addition, the 1972 Moscow agreement provided for exchanges of lunar samples with the Soviet Union, all since carried out.

Apollo Scientific Cooperation

Other important international participation in the Apollo program has included:

- A Swiss solar wind experiment placed on the lunar surface and later retrieved. Apollo 11, 12, 14, 15 and 16 missions were involved.

- A laser reflector left on the lunar surface by Apollo 11, made available for use by all countries.

- A German experiment to study the biological effects of cosmic radiation (heavy nuclei), flown on both Apollo 16 and 17.

US/USSR Scientific Cooperation

The May 1972 Summit agreement pledged the United States and the Soviet Union to continue cooperation already under way

between NASA and the Academy of Sciences of the USSR in space science. The principal results have been exchange of lunar samples; work on a common system of lunar geodetic coordinates; exchanges on active experiments in the magnetosphere; the exchange of detailed physiological data from Soyuz-Salyut and Apollo programs; and a continuing dialogue on common problems of planetary exploration which has been reflected in the exchange of findings from the 1971 US and Soviet missions to Mars, joint working sessions on exploration of the planets and agreement to exchange data and findings which could assist each side in future missions to Mars and Venus.

Sounding Rocket Projects

Sounding rocket programs have represented a broad area of international cooperation with some nineteen countries from sites in fourteen countries. Because of the relatively low costs of sounding rocket work, many countries without the resources for satellite projects are able to participate directly in valid scientific space flight projects using this technique. In addition, the small launching facilities developed in such countries as Brazil, India, Argentina and Pakistan have been available to NASA sounding rocket programs that have required special launch locations for research into unique polar, auroral and equatorial phenomena. More than half of NASA's total sounding rocket effort is in collaboration with foreign partners.

Ground-based Observations

More than 40 countries have been involved in a wide range of cooperative ground-based observations (as distinguished from flight projects). Scientists abroad have been able to carry out observations in support of orbiting satellite projects in such fields as ionospheric studies and geodesy. Many of these complementary ground activities have been necessary to achieve flight program objectives.

Research and Training

A variety of research and training opportunities for foreign scientists and engineers in space-related science and engineering at U.S. universities and NASA centers have been available and have involved more than 1,000 individuals from some 40 countries. The participants in these programs return to their countries to serve as the nuclei around which national space organizations and programs have developed.

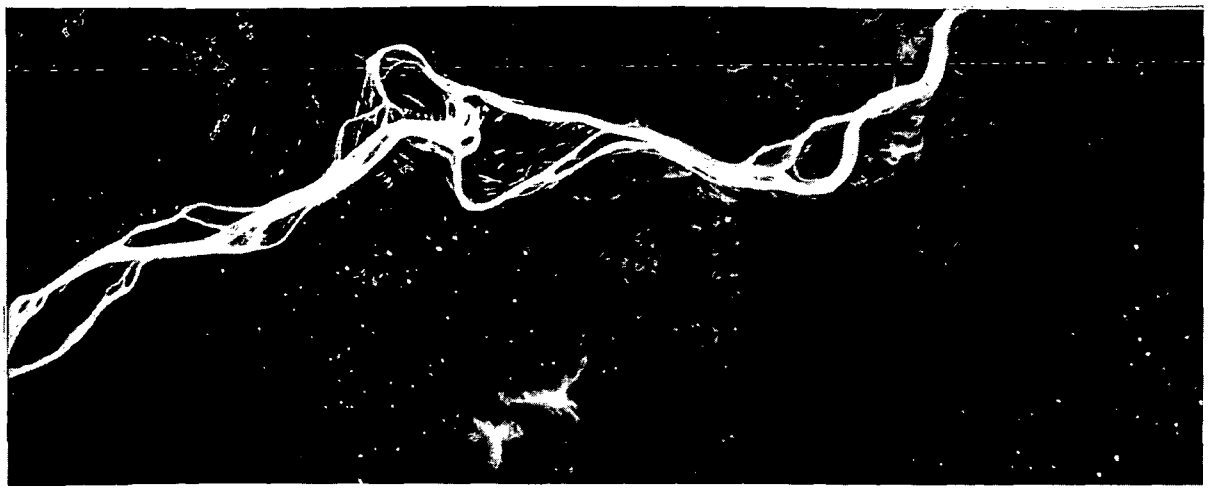

Figure 4. The Amazon River in the heart of the jungles of Brazil photographed in the red band by NASA's Earth Resources Technology Satellite (ERTS-1). The sensor is able to discriminate between water of varying quality due to sediment.

III. SPACE APPLICATIONS

Communications Satellites

Experimental communications satellites have for the past decade been an element in international collaboration.

Under an agreement with India, NASA will make available its ATS-F satellite scheduled for launching in 1974, for a one-year Indian instructional television experiment. Some 2,000 villages will be equipped to receive signals directly from the satellite by means of augmented TV receivers and 3,000 villages will receive programs through conventional ground relay stations. A unique feature of this experiment is the testing of the technical feasibility of satellite TV broadcast directly to community receivers in an operational setting. India is responsible for the construction of ground transmitters, the design and production of augmented TV receivers, the planning of instructional programs and the logistics required to coordinate and support all elements of the system.

In the early Relay, Telstar and Syncom experiments a dozen countries built ground terminals at their own expense to work with NASA in testing these satellites. Building in part on these beginnings, INTELSAT has evolved into an international organization of more than 80 members which has greatly expanded telecommunications capacity internationally, reduced costs substantially, and provided reliable international communication links to large portions of the globe for the first time. By 1974, more than 80 ground stations for satellites will have been established in about 60 countries.

Earth Resources Surveying

The launch of the first Earth Resources Technology Satellite (ERTS-1) in 1972 marked a major step toward the establishment of a comprehensive information base on the Earth's resources and its surface environment. The main purpose of this mission is to conduct experiments to determine the usefulness of multi-spectral sensing of the Earth on a global scale and on a repetitive basis for agricultural, forestry, geographic, geologic, hydrologic and oceanographic studies.

This is a new area for space applications, and one with great potential for other countries; hence, their great interest in this program.

Among experiments being conducted by foreign scientists for use of ERTS data are: detection of potential locust breeding sites in Saudi Arabia; snow surveys to assess the risks of spring flooding in Norway; land use and soil erosion in Guatemala; the hydrologic cycle of the Santa River basin in Peru; and winter monsoon clouds and snow cover in Japan. Foreign proposals selected include experiments in agriculture, forestry, geography, geology, environmental quality/ecology, hydrology, meteorology, demography, cartography and oceanography. The investigators selected are from Argentina, Australia, Bangladesh, Belgium, Bolivia, Botswana, Brazil, Canada, Chile, Colombia, Ecuador, FAO, Finland, France, the Federal Republic of Germany, Greece, Guatemala, India, Indonesia, Iran, Israel, Italy, Japan, Kenya, Republic of Korea, Lesotho, Mali, Mekong Commission, Mexico, Netherlands, Norway, Philippines, Peru, South Africa, Spain, Sweden, Switzerland, Thailand, United Kingdom and Venezuela. Each country funds it own experiment and makes results available to all.

Foreign scientists will also use data from America's first manned space station, Skylab in 1973 and ERTS-B satellite planned for early 1976.

Remote sensing of Earth from space is a potentially effective technique for conservation of natural resources on a global scale, and for better understanding and management of the interaction between man and these natural resources. Remote sensing will be used for mapping geographic features, crop and forestry cover, health of vegetation, types of soil, water storage in snow pack, geologic features which may be associated with mineral deposits, wind and sea conditions, and the location of likely feeding areas for fish. Forty-four investigations for the use of Skylab EREP data have been selected from 43 scientists in 21 countries and one international organization.

Under a 1971 agreement, the Canadian Department of Energy, Mines and Resources is cooperating with NASA in the experimental earth resources survey program, utilizing an ERTS data acquisition station near Prince Albert, Saskatchewan, and a data processing facility near Ottawa. The principal objective of the cooperation is to study the application of earth observation satellites to the detection of environmental conditions at and near the surface of the earth.

Brazil signed an agreement with the U.S. in 1973 to extend the cooperative experimental project in remote sensing. As a result, Brazil is establishing a data acquisition station and a data processing facility. All data and information will be freely shared with the domestic and international community.

Meteorological Satellites and Sounding Rockets

NASA's efforts in the weather satellite and rocket field have contributed greatly to international cooperation. Meteorological satellites now routinely deployed have been designed so that nations everywhere can use inexpensive (or easy-to-build) Automatic Picture Transmission (APT) sets to obtain daily weather prospects directly from U.S. satellites. These sets are in use in some 74 countries. Regular, coordinated weather rocket soundings on a North-South line in the Western Hemisphere have been undertaken in an Inter-American Experimental Meteorological Rocket Network (EXAMETNET). Since the program's inception in 1966, Argentina and Brazil have launched more than 100 rockets, synchronized with similar launchings from various U.S. sites. An agreement with the Soviet Union provides for the coordination of networks of meteorological rocket soundings along meridtional lines in the Eastern and Western Hemispheres.

NASA has cooperated with France in a meteorological satellite and balloon project, Eole, to test the feasibility of such a system for tracking global winds. Balloon and satellite launchings took place in 1971.

The May 1972 Summit agreement pledged the United States and the Soviet Union to continue cooperation already under way between NASA and the Academy of Sciences of the USSR in space applications. The principal results have been exchange of meteorological data from meridional sounding rocket networks in the Eastern and Western Hemispheres, conduct of a joint program of microwave measurements of surface phenomena in the Bering Sea, and progress in defining coordinated projects in remote sensing of the environment, as well as experiments designed to advance knowledge of temperature sounding from satellites.

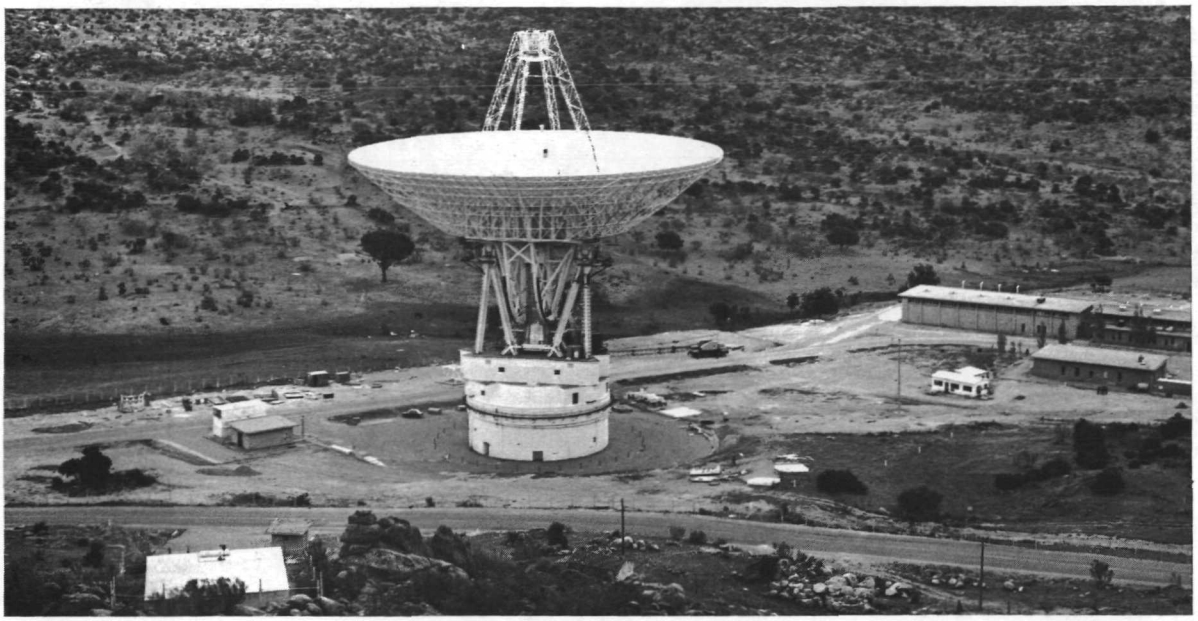

Figure 5. Deep Space Network station at Robledo de Chavela (Madrid), Spain. The parabolic or "dish" type antenna is 64 meters (210 ft.) in diameter. Deep Space Network stations are established in pairs at approximately 120° or one-third of the Earth's circumference apart. Besides the pair in Spain and South Africa, the others are the two at Goldstone, California, and at Woomera and Canberra, Australia.

IV. SPACE OPERATIONS SUPPORT

The tasks of tracking, communicating with, and acquiring data from the multitude of NASA's manned and automated spacecraft has required the extensive and intimate participation of 22 countries. Some 20 stations around the world are at present operated with active support, and often direct staffing, by nationals of the host countries. In several locations, the costs of operating the stations were borne by the host countries. NASA maintains close ties with compatible tracking networks of the European Space Research Organization (ESRO) and France; specific project support exchange arrangements are increasing in number.

Extensive operational arrangements were made with dozens of countries in Africa, Asia and South America for the staging and overflight of U.S. aircraft in conjunction with contingency assistance operations for the Mercury, Gemini and Apollo programs.

A system for the international exchange of information has been established by NASA and the ten-nation ESRO. Reports in their respective geographic regions are collected by NASA and ESRO, indexed and abstracted according to a common system, published, reduced to the same microfilm pattern and put on computer tapes. These are exchanged. Thus, a single notification and abstract program supported by ESRO and NASA serve the scientific and technical communities in Europe, as well as those in the United States.

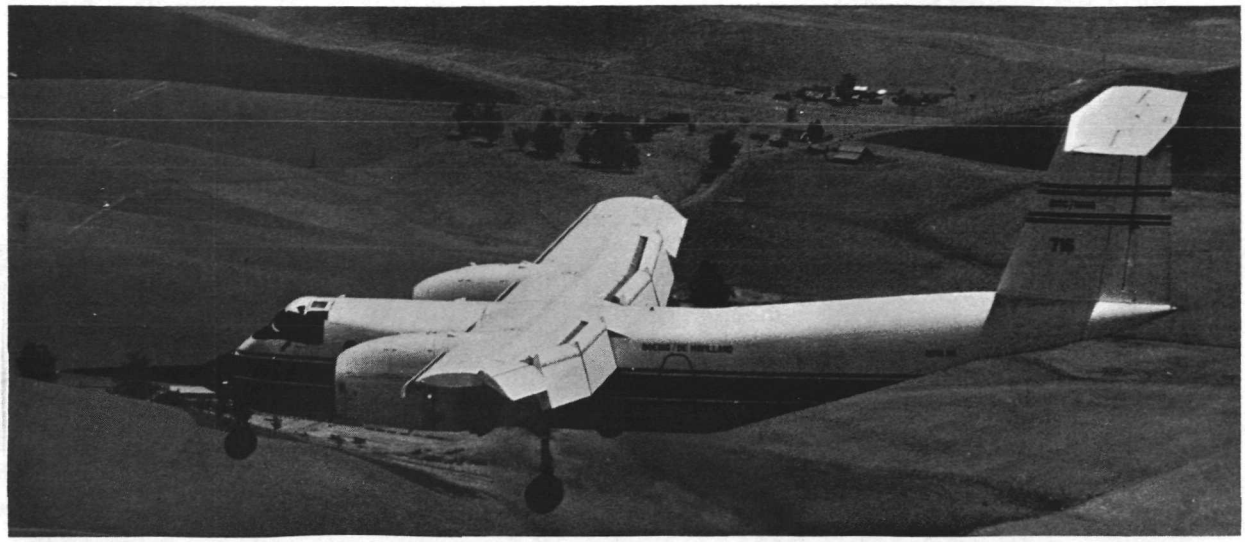

Figure 6. Augmentor Wing Jet STOL (short takeoff and landing) aircraft makes its first flight from NASA's Ames Research Center, Mountain View, California. The test is a Canadian-U.S. joint project.

V. COOPERATIVE INTERNATIONAL AERONAUTICS RESEARCH

Canada

The Canadian Department of Industry, Trade and Commerce (DITC) and NASA have sponsored a joint program to test the Augmentor Wing Powered Lift Principle in flight, a promising wing configuration for short takeoff and landing (STOL) aircraft. An extensively and specially modified aircraft, with a crew of two, is flying in a research program to explore, at low speeds, the inter-relationships among aerodynamics, handling qualities and performance of the Augmentor Wing concept.

The Augmentor Wing uses by-pass fan air from the engine which is ducted through the wings to a slot along the rear and ejected out between the flaps inducing, thereby, added flow over and around the wing and through the flaps and increasing wing lift.

The flight program conducted by NASA's Ames Research Center in California entails over 100 hours of flight tests and is to be completed by the summer of 1973. Flight tests were preceded by extensive wind tunnel research also jointly funded by Canada and the U.S.

France

The French National Office of Aerospace Research (ONERA) and NASA completed in 1972 a cooperative wind tunnel research program to test tilt rotors for V/STOL aircraft. Wind tunnels in the U.S. and France were used in carrying out the project.

Germany

The German Federal Ministry for Education and Science and NASA conducted two cooperative projects during 1969-70 based on the Dornier 31 (DO-31) Aircraft, a unique advanced Jet V/STOL Transport. In the first project, NASA conducted Flight Simulation Programs to study stability, control and handling qualities during landing, transition and descent phases of flight. In the second, NASA pilots flew the DO-31 for approximately 12 1/2 hours to test performance limitations under various V/STOL descent and ascent conditions.

United Kingdom

Aeronautical authorities of the United Kingdom and NASA have agreed to conduct special research projects of mutual interest in addition to many less formal exchanges. The first such project utilized the Hunting-126 Aircraft (Jet-Flap V/STOL), for full-scale wind tunnel tests. The second was a cooperative research program on selected runway surfaces in the U.K. and the U.S. A third involved flight testing in the U.K. of NASA's XH-51 rigid rotor helicopter. The fourth, presently in progress, involves research to evaluate vectoring in forward flight (VIFF) of engine exhaust nozzles on VTOL aircraft.

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NASA has established through its international programs a broad base of institutions, facilities, competence, and patterns of cooperation from which it can move forward in the future. It is engaged in a major new effort to increase

international cooperation in the seventies by extending its activities with other nations to include participation in the development and use of major new space systems and in the experimental development of new applications of space technology. The objective is to bring about a greater sharing of both the costs and the benefits of the exploration and utilization of space. A related objective has been to open new paths of cooperation with the Soviet Union.

As in all matters involving international agreement, progress takes time, but the 1970's continue to see major advances in international space cooperation beyond the substantial achievements of the past.

SELECTED STATISTICS ON NASA'S INTERNATIONAL ACTIVITIES

SUMMARY OF STATISTICS		To January 1, 1973
I. Total Countries** which have entered into Agreements for the following:		55*
Cooperative Flight Projects	25**	
Earth Resources Survey	39**	
Lunar Sample Analysis	20**	
Tracking and Data Acquisition	22	
Reimbursable Launchings	4	
II. Total Countries** in which scientists participate in Cooperative Associations		85*
Meteorological Research	80	
Other Cooperative Associations	52**	
Personnel Exchanges	41**	
TOTAL Countries** cooperating in some form with the United States (NASA)		94*
III. Countries** which exchange scientific and technical information		63
IV. Countries** which have sent visitors to NASA		126
GRAND TOTAL -- Countries**		134*

*Duplication eliminated
**Countries/International Organizations

To January 1, 1973

I. Countries, and ESRO, which have entered into Agreements 55

COOPERATIVE SATELLITE AND PROBE PROJECTS

Countries, and ESRO, under agreement with NASA 9

Cooperative Satellites and Probe Launchings agreed 24

Cooperative Satellites already launched: 18

Canada		
Alouette I	-September	29, 1962
Alouette II	-November	29, 1965
ISIS-I	-January	30, 1969
ISIS-II	-March	31, 1971
France		
FR-I	-December	6, 1965
EOLE	-August	16, 1971
Germany		
AZUR I	-November	7, 1969
Barium Ion Cloud Probe	-September	20, 1971
AEROS	-December	16, 1972
Italy		
San Marco I (prototype)	-December	15, 1964
San Marco II	-April	26, 1967
San Marco III	-April	24, 1971
United Kingdom		
Ariel I	-April	26, 1962
Ariel II	-March	27, 1964
Ariel III	-May	5, 1967
Ariel IV	-December	11, 1971
ESRO		
IRIS	-May	17, 1968
Aurorae	-October	3, 1968

To January 1, 1973

EXPERIMENTS ON NASA SATELLITES

Countries participating	8
International experiments selected	31
International experiments flown	26

France		
OGO-2	-October	14, 1965
OGO-4	-July	28, 1967
OGO-5	-March	4, 1968
OSO-5	-January	22, 1969
OGO-6	-June	5, 1969
Germany		
Apollo 16	-April	16, 1972
Apollo 17	-December	6, 1972
Italy		
OSO-6	-August	9, 1969
Netherlands		
OGO-5	-March	4, 1968
Switzerland		
Apollo 11	-July	16, 1969
Apollo 12	-November	14, 1969
Apollo 14	-January	31, 1971
Apollo 15	-July	26, 1971
Apollo 16	-April	16, 1972
United Kingdom		
Explorer 20	-August	25, 1964
Explorer 31 (2 experiments)	-November	29, 1965
OSO-4 (2 experiments)	-October	18, 1967
OGO-5 (2 experiments)	-March	4, 1968
OSO-5	-January	22, 1969
OSO-6	-August	9, 1969
NIMBUS-4	-April	8, 1970
OAO-3	-August	21, 1972
NIMBUS-5	-December	10, 1972

To January 1, 1973

COOPERATIVE SOUNDING ROCKET PROJECT	
Countries under cooperative agreement with NASA and executing cooperative launchings	19
Total cooperative sounding rockets launched*	795
EARTH RESOURCES SURVEY	
Countries**, which are participating in the analysis of data returned from the Earth Resources Technology Satellite (ERTS-1)	39**
LUNAR SAMPLE ANALYSIS PROGRAM	
Countries, and ESRO, which have participated in the Lunar Sample Analysis Program	20***
COMMUNICATIONS SATELLITE AND ATS	
Countries which have provided ground stations for cooperative testing of experimental COMSATS	12
Countries which have participated in communications experiments in the Applications Technology Satellite series 1 through 5	8
AERONAUTICS	
Countries cooperating in aeronautical research	4

Countries which have entered into Tracking and Data Acquisition Agreements	22****
Countries in which NASA TDA stations are now operational	14
NASA overseas TDA stations	21

* Does not include NASA launchings at Churchill Research Range, Canada

** Countries/International Organizations

*** USSR, under the Space Science and Applications Agreement of January 1971

**** Includes NASA electronic stations and SAO optical stations

NASA-HQ

To January 1, 1973

REIMBURSABLE LAUNCHINGS

Reimbursable Launchings agreed (Canada, Italy, United Kingdom and ESRO)	13
NASA Launchings of Foreign Spacecraft accomplished	6

Canada

ANIK-1	-November 9, 1972

ESRO

HEOS-I	-December 5, 1968
BOREAS (ESRO I-B)	-October 1, 1969
HEOS-2	-January 31, 1972
TD-1	-March 12, 1972
ESRO IV	-November 20, 1972

Italian Launchings of NASA Spacecraft accomplished from San Marco Range	3

Explorer 42	-December 12, 1970
Explorer 45	-November 15, 1971
Explorer 48	-November 16, 1972

		To January 1, 1973
II.	Countries, and ESRO, which have participated in cooperative associations	85*
	METEOROLOGICAL RESEARCH	
	Countries which have taken part in synchronized gathering of data with NASA meteorological satellite photography and countries known to have used APT	80*
	OTHER COOPERATIVE ASSOCIATIONS	
	Countries** which have participated in ground-based activities relating to ionospheric satellites, geodetic satellites, solar eclipse experiments, Moonwatch, and balloon flights	52*
	PERSONNEL EXCHANGES	
	Total countries, and ESRO, which have participated in personnel exchanges programs	41*
	International Resident Research Associates in NASA Centers and JPL	567
	NASA International Graduate Fellows in U.S. universities	374
	Foreign technical trainees at NASA Centers in support of cooperative projects and ground facility operations	607

* Duplications eliminated
**Countries/International Organizations

		To January 1, 1973
III.	Countries*which exchange scientific and technical information	63
	Informal exchange arrangement with organizations	237
	Exchange services provided to additional organizations	201
IV.	Countries*which have sent visitors to NASA	126

VISITS PROGRAM

Visitors (cumulative)	approximately	53,000
Current annual rate	approximately	4,000

* Includes ESRO/ELDO